Estimating areas and volumes of water in the region,
San Pablo Bay to Stockton and Walnut Grove
William J (BJ) Miller
November 17, 2005

I estimated the area and volume of water in 15 areas of the Bay-Delta system. These are areas typically sampled in various surveys of the abundance of delta smelt. The estimates are as follows:

area	surface area acres	volume acre-feet
east San Pablo Bay	22,900	316,220
Napa River	3,880	48,130
Carquinez Strait	5,130	212,810
Suisun Bay	18,580	293,380
Suisun Marsh	5,240	75,470
Chipps Island	5,000	101,670
lower Sacramento R.	7,210	151,030
Cache Slough	2,530	34,590
upper Sacramento R.	2,210	45,400
Sacramento Ship Channel	1,422	28,618
lower San Joaquin R.	5,880	108,720
near Franks Tract	10,830	196,780
east-southeast Delta	3,850	76,540
east-central Delta	3,240	55,610
southeast Delta	4,420	72,320

The areas are shown on the accompanying figure and described as follows:

- **East San Pablo Bay**: area bounded by a semi-circle whose center is in the center of the main channel due north of Davis Point and whose radius is the distance from that point to Pinole Point.
- **Napa River**: from the southernmost point in the main dredged channel to the downstream end of Horseshoe Bend, including sloughs to the west of Napa River.
- **Carquinez Straight**: bounded on the west end by a line due north from Davis Point and on the east end by Benicia Bridge.
- **Suisun Bay**: from Benicia Bridge to the mouths of Suisun and Montezuma Sloughs to a north-south line through the center of Snag Island.
- **Suisun Marsh**: areas surrounding Suisun Bay to the west, north, and east, including Suisun Slough and tributaries and Montezuma Slough and tributaries, and sloughs north of Honker Bay including sloughs on Simmons, Wheeler, and Hammond Islands.
- **Chipps Island**: bounded on the west by a north-south line through the center of Snag Island and on the east by a north-south line through New York Point.
- **Lower Sacramento River**: bounded on the west by a north-south line through New York Point, on the south by Browns, Winter, and Sherman Islands, including body of water east of Sherman Island to Mayberry Cut, and upstream to a point 2000 yards upstream from Threemile Slough. Includes Horseshoe Bend at Decker Island and Threemile Slough to Sevenmile Slough.
- **Upper Sacramento River**: bounded downstream by a point 2000 yards upstream from Threemile Slough, bounded upstream by the Delta Cross Channel, including Georgiana Slough.
- **Cache Slough**: bounded downstream by the Sacramento River, includes Cache, Lindsey, Shag, and Prospect Sloughs, the lower 7,000 yards of the Sacramento Deep Water Ship Channel, and Miner Slough to the northwest corner of Ryer Island.
- **Sacramento Ship Channel**: The manmade portion of the ship channel from a point beginning 7,000 yards from the confluence with Miner Slough to the north end of the ship channel, including the turning basin.
- **East-Central Delta**: Both forks of Mokelumne River to confluence with San Joaquin River excluding Georgiana Slough, Beaver, Hog, and Sycamore Sloughs, Potato Slough, Little Potato Slough, Little Connection

Slough north of Potato Slough, White Slough, Bishop Cut north of Telephone Cut, Telephone Cut.

- **Lower San Joaquin River**: bounded downstream by a line from Point Sacramento to Point San Joaquin, including waters in and south of Browns and Winter Island, upstream to a line across the main channel from Blind Point, including Big Break to the mouth of Dutch Slough, including Mayberry Slough and Donlon Island.
- **Near Franks Tract**: Area bounded by the following points: east end of Dutch Slough, southwest corner of Holland Tract not including Rock Slough, power cable towers at Old River about 1000 yards north of Rock Slough, east end of Little Mandeville Island, San Joaquin River at downstream side of confluence with Middle River, west end of Potato Slough, mouth of Mokelumne River, Threemile Slough south of Sevenmile Slough including Sevenmile Slough, to a line across the San Joaquin River at Blind Point, to the west end of Dutch Slough, not including Big Break.
- **East-Southeast Delta**: Area bounded by the following points: San Joaquin River at downstream side of confluence with Middle River, Little Connection Slough at Potato Slough, Honker Cut at White Slough, Bishop Cut at Telephone Cut, around sloughs at north side of Shima Tract, around Fourteenmile Slough, San Joaquin River at French Camp Slough, Turner Cut at Empire Cut, Middle River at south side of confluence with Columbia Cut, including Connection Slough.
- **Southeast Delta**: Area bounded by the following: San Joaquin River at French Camp Slough, Middle River at northeast corner of Union Island, south side of Clifton Court Forebay, end of Rock Slough, power cable towers at Old River about 1000 yards north of Rock Slough, east end of Little Mandeville Island, Middle River at south side of confluence with Columbia Cut, Turner Cut at Empire Cut, San Joaquin River at French Camp Slough.

The surface area and volume of water for each area were estimated for mean tide as follows: NOAA navigation charts, 1:40,000 scale, based on data from the early 1990s, were used for these estimates. Surface areas were estimated by dividing all water surface areas into triangles or trapezoids and measuring the area of each by hand. Volumes for each surface area were

estimated as the average of soundings for that surface area. Some areas contained ship channels for which no soundings were shown on the charts. However, the depths of ship channels were noted on the charts, and these depths could be accounted for in the averages.

All soundings were relative to mean lower low water. Mean high and low tidal elevations, relative to mean lower low water, were given for various locations. From these data I calculated a correction for each surface area to convert mean lower low water soundings to mean tide soundings. I averaged two differences to obtain these corrections. One difference was between mean high water and mean lower low water. The other was between mean low water and mean lower low water for each area. In some shallow areas it is possible that this correction would have resulted in an increase in surface area. I did not attempt to account for this change.

The NOAA charts did not show soundings for Sherman Lake, Big Break, Franks Tract, or Mildred Island. I obtained soundings for these from DWR bathymetry data. The charts did not show soundings for the manmade portion of the Sacramento Ship channel, upstream of Miner Slough. I obtained bathymetry data from USGS (Pete Smith, personal communication), developed cross section depths from those data, and used those cross sections along with the distance between cross sections to estimate the depth of the ship channel.

These data were used to estimate the population of adult delta smelt from the Kodiak Spring trawl data. Adult delta smelt reside in the upper layers of

the water column. The Kodiak Spring Trawl samples to a depth of about six feet. For those estimates I assumed that no adult smelt resided below 12 feet depth and that the density of smelt in the upper 12 feet of the water column was equal to that found from the Kodiak Spring Trawl. Therefore, it was necessary to estimate the depth of water in the upper 12 feet of each area.

Also, delta smelt are found in Montezuma Slough in Suisun Marsh, but few if any adult smelt are found throughout the rest of Suisun Marsh (ref). Therefore, it was necessary to estimate the volume of the upper 12 feet of Montezuma Slough, excluding the rest of Suisun Marsh. The table below shows the resulting volumes.

The volume of water of depth less than 12 feet, excluding the volume of Suisun Marsh except for Montezuma Slough

area	volume acre-feet
east San Pablo Bay	212,270
Napa River	30,549
Carquinez Strait	61,391
Suisun Bay	173,288
Suisun Marsh	16,602
Chipps Island	50,986
lower Sacramento R.	79,789
Cache Slough	18,079
upper Sacramento R.	33,430
Sacramento Ship Channel	17,124
lower San Joaquin R.	56,417
near Franks Tract	117,944
east-southeast Delta	39,440
east-central Delta	37,018
southeast Delta	47,546

The table below shows areas and volumes for 20 mm survey stations.

station	surface area acres	Volume acre-feet
323	22,900	316,220
340	1,830	27,570
342	1,160	11,720
343	630	4,930
344	100	1,580
345	100	1,580
346	100	1,580
405	5,130	212,820
411	5,710	119,430
418	2,080	30,410
501	2,080	44,470
504	4,650	81,170
508	1,120	42,240
513	1,990	45,410
519	2,200	25,580
520	380	12,260
602	6,900	59,600
606	4,650	85,510
609	1,530	19,910
610	620	4,100
703	2,700	42,460
704	390	10,830
705	390	10,830
706	1,000	24,540
707	1,360	32,600
711	1,660	43,200
716	2,210	22,720
801	1,320	30,580
804	4,160	64,670
809	1,790	35,740
812	1,470	41,130
815	1,970	40,380
901	4,810	45,290
902	670	15,450
906	3,200	75,540
910	1,070	17,130
912	690	14,960
914	2,050	37,810
915	700	12,010
918	1,280	12,030
919	1,100	17,950

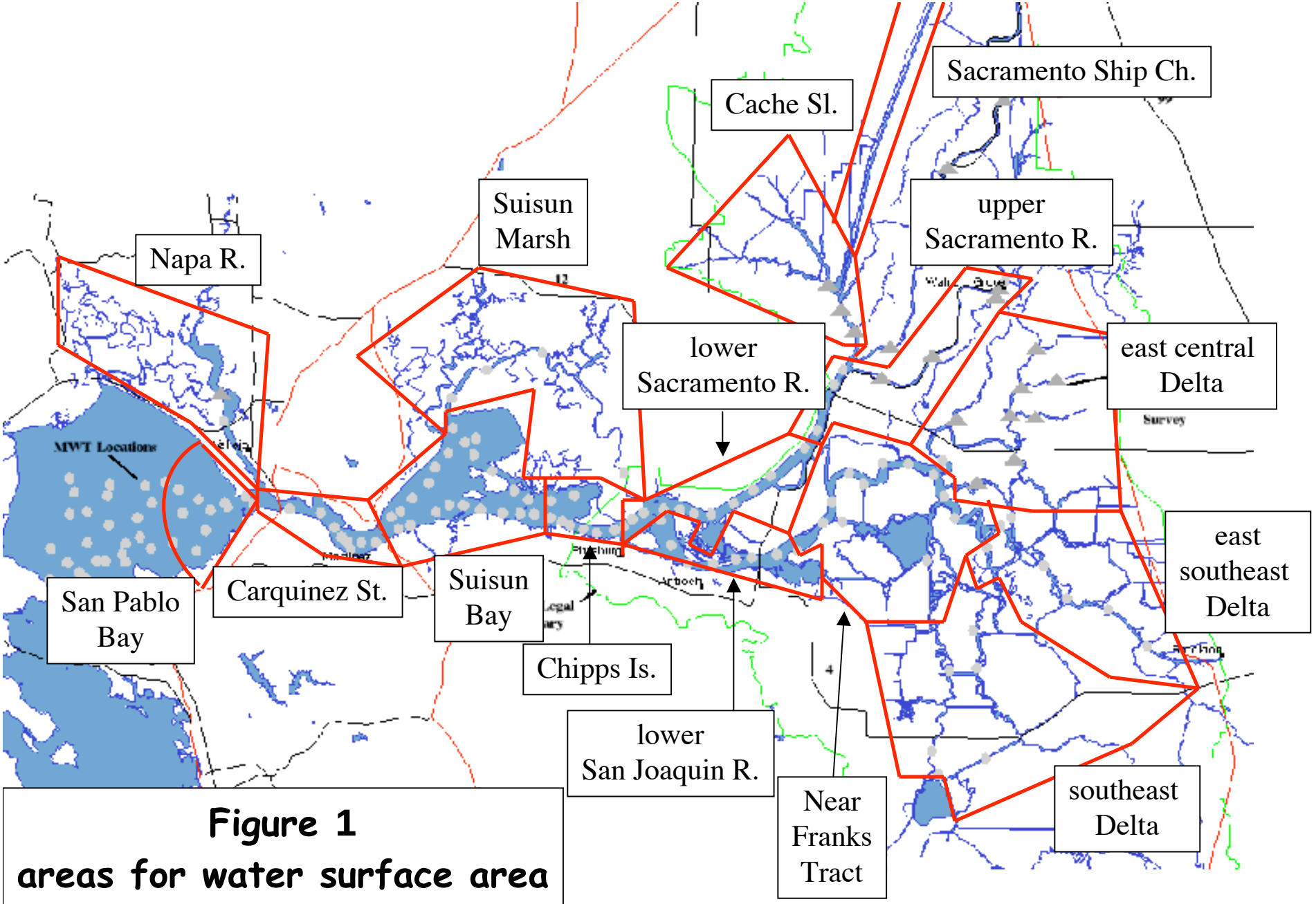

Figure 1
areas for water surface area & volume estimates